errors in Kepler's tables probably accounting for his omitting it. Horrocks made all preparations for observing the phenomenon, arranging the image projected from his telescope (which had cost him half-a-crown) on a sheet of white paper having a circle six inches in diameter traced on it, the circumference being divided into degrees.   He watched from sunrise to nine o'clock, and from ten until noon.   Resuming his labour again shortly after three, he was overjoyed to find a round black spot just within the limb of the sun, at the internal contact. During some thirty minutes he was enabled to make many observations, which he considered very successful.   Besides these definite scientific achievements, he wrote upon many different phenomena connected with the solar system, including the motions of Jupiter, Saturn, and various comets.   The illustration on p. 257, reproduced from Mr. Dodgson's paper, shows Carr's house at Hoole, where Horrocks made his transit observation, and also the monumental tablet erected in 1826 to his memory in Hoole Church.

JUBILEE OF THE IMPERIAL GEOLOGICAL INSTITUTE OF VIENNA.

TO celebrate the fiftieth anniversary of the foundation of the Imperial Geological Institute of Vienna, a jubilee meeting was held on June 9 in the Great Hall of the Institute under the presidency of its present director, Hofrath Guido Stache.   The meeting was attended by a number of high Government officials, geologists, and representatives of national industries and scientific associations.

The director having welcomed the guests, speeches of congratulation were delivered by his Excellency the Minister for Spiritual and Educational Affairs, Dr. W. Ritter von Hartel, his Excellency the Minister for Railways, Dr. H. Ritter von Wittek, and the Mayor of Vienna, Dr. C. Lueger.   These were succeeded by the following representatives of scientific institutions and industries, who presented addresses: Geheimrath von Richthofen, conveying the good wishes of the Prussian Royal Academy of Sciences, the Gesellschaft für Erdkunde, and the German Geological Society; Prof. Dr. Beyschlag, for the Royal Prussian Geological Institution and the Berg Akademie of Berlin; Geheimrath Dr. Lepsius, for the Grand-ducal Institute of Hesse and the Upper Rhine Geological Society at Darmstadt; Prof. Dr. E. Naumann, for the Senckenberg Natural Science Society of Frankfurt a.-M.; Sectionsrath Boeck, for the Hungarian Geological Institution and the Hungarian Geological Society; and Chief Geologist Pethö, for the Natural Science Association of Buda-Pesth.

Among Austrian representatives there were: Prof. E. Suess, as President of the Imperial Academy of Sciences; Prof. L. Szajnocha, for the Cracow Academy; Prof. Woldrich, for the Bohemian Francis Joseph Academy; Hofrath Steindachner, for the Court Museum of Natural History; his Excellency Field-Marshal Ritter von Steeb, as Commandant of the Military Geographical Institute; Rector Zeisel, for the Agricultural College; Hofrath Juraschek, for the Central Statistical Commission; Prof. Doelter, for the Steiermark Scientific Society; and Vice-President Straberger, for the Francisco-Carolineum at Linz.

The good wishes of the Lower Austrian Chamber of Commerce were presented by the President of the Northern Railway, Hofrath Jeitteles, and the congratulations of societies for the advancement of allied sciences were tendered by Custos Marenzeller, Freiherr von Poche, Hofrath Toula, Freiherr von Andrian, and Councillor Karrer.   In conclusion, the Chairman read those parts of the Jubilee Report which referred to the advancement of the Institute by the Emperor and the Government.

Among the 264 messages of congratulation received the following are specially mentioned: from the Geological Survey of Great Britain and Ireland, the Geological Society and the Iron and Steel Institute in London, the Smithsonian Institution and the United States Coast and Geodetic Survey in Washington, the American Philosophical Society in Philadelphia, and the Cincinnati Society of Natural History.   Also those of the Imperial Russian Academy of Sciences, the Russian Geological Committee, and the Imperial Russian Mineralogical Society at St. Petersburg; the Naturalists' Society of Moscow, the Royal Swedish Academies at Stockholm and Upsala, the Academia dei Lincei and the Ufficio Geologico in Rome, the Science

Academies of Naples and Turin, the Belgian Geological Society the Royal Academy of Amsterdam, and scientific associations and institutions at Hallé, Dresden, Leipzig, Breslau and Göttingen.

The Institute, or Geologische Reichsanstalt, was founded in 1849 by the then Minister of Mines and Agriculture, von Thinnfeld, with the object of working out the geology of the whole empire, collecting and arranging the material, and publishing the results in maps and memoirs.   Haidinger was its first director, and his chief geologist was Freiherr von Hauer, who was appointed director on Haidinger's death in 1866.   In those early days the position of the Institute was not by any means secure.   In 1859 an attempt was made to abolish it as a separate institution and to incorporate it with the mathematical and natural science section of the Imperial Academy of Sciences. But the proposed change failed to obtain the approval of the Reichsrath.

Between 1867 and 1871, under von Hauer's direction, a geological map of the Austro-Hungarian Monarchy was published, to a scale of 1 in 576,000.   Under the supervision of the present director, Hofrath G. Stache, the publication of a series of detail maps has been commenced.   The publications of the Institute comprise the annual *Jahrbuch*, which has now reached its fiftieth volume, the *Verhandlungen*, and the *Abhandlungen*. The latter are in 4to, and up to the present they have an aggregate of 7000 pages and 950 lithographic plates. Besides, explanatory letterpress is issued with each section of the new detailed geological map drawn to a scale of 1 in 75,000.

A chemical laboratory is attached to the Institute, which undertakes geological and industrial analyses.   This laboratory was suppressed for several years, owing, it is said, to the overshadowing influence of another laboratory connected with the Vienna Academy of Sciences (see Dr. Tietze's "Life of Franz von Hauer," Vienna, 1900).

The Institute possesses extensive geological and mineralogical collections, chiefly from Austrian and Hungarian districts. These are exhibited in twenty-one rooms, some of which are really halls of great architectural beauty.   The library contains over 40,000 volumes.

The Reichsanstalt is under the supervision of the Minister for Spiritual and Educational Affairs.   Its annual income is 18,000*l*. Its staff numbers twenty persons, twelve of whom are employed in the Geological Survey.

A PARTIAL EXPLANATION OF SOME OF THE PRINCIPAL OCEAN TIDES.

AT the meeting of the U.S. National Academy of Sciences on April 19, a paper bearing the above title was read by Mr. R. A. Harris, of the United States Coast and Geodetic Survey.   An abstract summarising the chief results arrived at has been published by the Academy: the full memoir is to be issued as an Appendix to the Annual Report of the Survey for 1899-1900.   The abstract is too short to allow of critical examination of the methods employed in these inquiries, but some of the conclusions stated are very significant and important.

Mr. Harris enunciates the fundamental proposition of his investigation in the following terms: "Considering the actual distribution of land and water, a few computations upon hypothetical cases will suffice to convince one that as a rule the ocean tides, as we know them, are so great that they can be produced only by successive actions of the tidal forces upon oscillating systems, each having, as free period, approximately the period of the forces, and each perfect enough to preserve the general character of its motion during several such periods were the forces to cease their action . . . having once for all constructed a set of force diagrams for the various latitudes, we have only to discover those regions which have a free period of oscillation about equal to the period of the forces, and to then ascertain at what time the particles should be at elongation in their nearly rectilinear paths."

The main idea underlying this proposition is not altogether new, the novelty in the present paper is rather an attempt to locate and define areas which seem to account for the principal ocean tides, due regard being had to the difficulties arising from irregularities in the natural boundaries of such areas where such exist, or from the absence of natural boundaries.   Each *oscillating area* is one of comparatively simple form, of which

the free period of oscillation, supposing its boundaries all rigid, would not differ much from twelve lunar hours, and the forces are connected with the dominant ocean tides by applying to such an area, or to a system of such areas, the rule that " if to the particles of water in a given oscillating system, each area of uniform depth, and wherein the resistances are proportional to the velocities of the particles, a series of simple harmonic forces having for period the free period of the body of water be applied and a permanent state established, then must the time of elongation be simultaneous with the time when the virtual work of the external periodic forces upon the system becomes zero." Applying this rule, by means of the tidal-force diagrams the time can be found when " the aggregate of the elementary masses, each multiplied by the intensity of the tidal force in the direction of the displacement of the element, and again by a quantity proportional to the value of the maximum displacement (since the oscillation is harmonic), is zero " : this is the time of high or low water. The results of this method appear at once in a few simple cases : thus in an east-and-west canal half a wave-length long it is high water at the east end at the component hour 0 or 12, the time meridian being understood to be the meridian of the middle point of the canal ; in a meridional canal one wave-length long, whose centre lies

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—Applications are invited for the new Wykeham professorship of physics, referred to in a note on May 24 (p. 91). The election will take place in November, and applications must reach the Registrar not later than October 24. The following particulars are given in the *University Gazette* :—The subjects on which the professor will chiefly lecture and give instruction will be electricity and magnetism. The professor will have the charge of any laboratory which the University may assign to him. It is expected that rooms, now otherwise occupied, will be assigned to the professor for a laboratory in the course of the year 1901 ; 700*l.* will be appropriated to fitting up the laboratory, and provision has been made for spending 250*l.* a year for the first two years on assistance and maintenance. As soon as the professor is elected, he will be entitled to be admitted to a Fellowship at New College of the annual value of 200*l.* In addition, from January 1, 1901, he will receive from New College (1) an annual payment of 200*l.* ; and (2) a further annual payment of 100*l.* so long as the College has funds available for the purpose. It is anticipated that this further payment will be paid for not less than twelve or thirteen years.
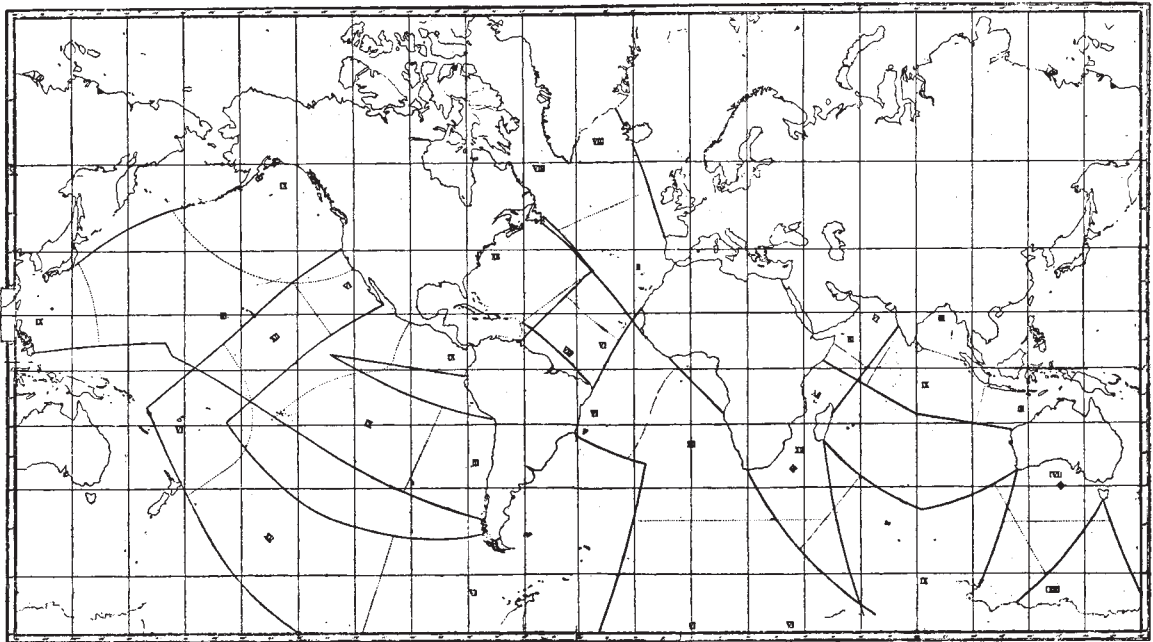
between 45° south and 45° north latitude, it is high water at both ends at the component hour 9 ; if the centre lies beyond these limits, the component hour of high water at the ends is 3.

Before laying down the oscillating areas, Mr. Harris gives a number of lemmas which have to be borne in mind as modifying the motions discussed. To quote one example : "Suppose a stationary oscillation to exist in a canal communicating with a tided sea ; let the length of the canal lie between 0 and $\frac{1}{4}\lambda$, then at the time of high water outside it is high water throughout the canal (*e.g.* many Alaskan canals). If the length lie between $\frac{1}{4}\lambda$ and $\frac{3}{4}\lambda$, it is low water for a distance of $\frac{1}{4}\lambda$ from the head at the time it is high water outside (*e.g.* Irish Sea, node at Courtown ; English Channel, node at Christchurch). If the length be equal, or nearly equal, to $\frac{1}{4}\lambda$, then the horizontal motion at the mouth, instead of the vertical motion, determines the time of tide within ; this tide will be three hours later than the tide outside (*e.g.* the Gulf of Maine).

The systems supposed to account for the principal semi-daily movements of the oceans are outlined on the chart which we reproduce in a reduced form ; the Roman numerals indicate the co-tidal hours. The main systems are seven in number : (1) North Atlantic, (2) South Atlantic, (3) North Pacific, (4) South Pacific, (5) North Indian, (6) South Indian, (7) South Australian (solar).

PROF. MCCALL ANDERSON, Professor of Clinical Medicine in the University of Glasgow, has been appointed to the chair of Systematic Medicine in the same University, in place of Sir W. Gairdner, resigned.

THE war in South Africa has raised many questions of great national importance which are fortunately receiving the attention of many thoughtful people. Prominent among these subjects of discussion is the urgent problem of how to obtain an improved supply of suitably educated officers, which was recently dealt with in a paper read by the Headmaster of Eton at the Royal United Service Institution. Dr. Warre maintains that a wider diffusion of the knowledge of the *elementa* of military science among the educated youth of the nation would tend, not only to raise the standard of military knowledge in the Army and Auxiliary Forces, but to improve the methods of communicating that knowledge to the rising generation, an indirectly widen the area from which a supply of well-educated officers may constantly be drawn. The great majority of the headmasters of our public schools agree with Dr. Warre, and he has drawn up, at the request of the War Office, a memorandum in which he advocates the need for a new Act of Parliament, the tenor of which should be "that all persons *in*